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(REV. 5-93)U.S. DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICEATTORNEY'S DOCKET NUMBER  
10191/1583TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/673063

INTERNATIONAL APPLICATION NO.  
PCT/DE99/00020INTERNATIONAL FILING DATE  
(08.01.99)  
08 January 1999PRIORITY DATES CLAIMED:  
(08.04.98) (15.09.98) (12.10.98)  
08 Apr. 1998 15 Sept. 1998 12 Oct. 1998

## TITLE OF INVENTION

RAIN SENSOR

## APPLICANT(S) FOR DO/EO/US

Gebhard MICHENFELDER, Guenther RIEHL, Manfred BURKART and Klaus ROTH

Applicant(s) herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (unsigned).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

## Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: International Search Report, International Examination Report and PCT/RO/101.

EXPRESS MAIL NO.: 8L302 701211

U.S. APPLICATION NO. 09/1873063  
37 C.F.R. 1.5INTERNATIONAL APPLICATION NO.  
PCT/DE99/00020ATTORNEY'S DOCKET NUMBER  
10191/1583

- 17.
- ☒
- The following fees are submitted:

**Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Search Report has been prepared by the EUROPEAN PATENT OFFICE or

JPO ..... \$860.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... \$690.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but  
international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$710.00Neither international preliminary examination fee (37 CFR 1.482) nor international search  
fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$1,000.00International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims  
satisfied provisions of PCT Article 33(2)-(4) ..... \$100.00

CALCULATIONS | PTO USE ONLY

**ENTER APPROPRIATE BASIC FEE AMOUNT =** \$ 860Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months  
from the earliest claimed priority date (37 CFR 1.492(e)).

\$

Claims	Number Filed	Number Extra	Rate	
Total Claims	22 - 20 =	2	X \$18.00	\$ 36
Independent Claims	1 - 3 =	0	X \$80.00	\$ 0
Multiple dependent claim(s) (if applicable)			+ \$270.00	\$

**TOTAL OF ABOVE CALCULATIONS =** \$ 896Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must  
also be filed. (Note 37 CFR 1.9, 1.27, 1.28).

\$

**SUBTOTAL =** \$ 896Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30  
months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

**TOTAL NATIONAL FEE =** \$ 896Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

\$

**TOTAL FEES ENCLOSED =** \$ 896

Amount to be:	
refunded	\$
charged	\$

- a.
- ☐
- A check in the amount of \$\_\_\_\_\_ to cover the above fees is enclosed

- b.
- ☒
- Please charge my Deposit Account No.
- 11-0600
- in the amount of
- \$896.00**
- to cover the above fees. A duplicate copy of this sheet is enclosed.

- c.
- ☒
- The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No.
- 11-0600
- . A duplicate copy of this sheet is enclosed.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Kenyon &amp; Kenyon

One Broadway

New York, New York 10004

SIGNATURE

Richard L. Mayer, Reg. No. 22,490

NAME

DATE

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Inventors : MICHENFELDER et al.  
Serial No. : To Be Assigned  
Filed : Herewith  
For : RAIN SENSOR  
Examiner : To Be Assigned  
Art Unit : To Be Assigned

Assistant Commissioner  
for Patents  
Washington, D.C. 20231  
Box Patent Application

**PRELIMINARY AMENDMENT**

SIR:

Kindly amend the above-identified application before examination, as set forth below.

**IN THE SPECIFICATION:**

Please amend the specification as follows:

On page 1, delete lines 1-2, and in their place insert

**--Field Of The Invention**

The present invention relates to a rain sensor.--.

On page 1, line 4, change "Background Information" to

**--Background Information--.**

On page 1, line 21, change "Advantages of the Invention" to

**--Summary Of The Invention--.**

On page 1, line 23, delete "having the features cited in Claim 1".

EX302 70/211

On page 1, line 24, delete "essentially".

On page 1, line 25, delete "essentially".

On page 1, line 27, delete "necessary".

On page 2, line 27, before "invention" insert --present--.

On page 3, delete lines 11-29 and in their place insert:

--Brief Description Of The Drawings

Figure 1a shows a diagrammatic side view of a rain sensor according to the present invention.

Figure 1b shows a diagrammatic plan view of the rain sensor of Figure 1a.

Figure 2 shows a diagrammatic section of the rain sensor according to the present invention in an exploded view.

Figure 3 shows a light conducting element in a perspective view.

Detailed Description--.

**IN THE CLAIMS:**

On page 7, line 1, delete "Patent Claims", and insert:

--What Is Claimed Is:--.

Please cancel original claims 1-19, without prejudice, and enter the following new claims.

20. (New) A rain sensor arranged with respect to a measuring distance in which is arranged a windshield, comprising:

a housing including a light conducting element forming a cover of the housing; and

a plurality of optical and electronic components mounted in the housing and including:

at least one transmitter for transmitting an electromagnetic wave, and  
at least one receiver for receiving the electromagnetic wave, the  
measuring distance influencing a wave propagation between the at least one transmitter  
and the at least one receiver such that when a coating forms on the windshield, an output  
signal sensed by the at least one receiver is changed.

21. (New) The rain sensor according to claim 20, wherein the rain sensor is used in a motor vehicle.

22. (New) The rain sensor according to claim 20, wherein the coating is a result of wetting by precipitation.

23. (New) The rain sensor according to claim 20, wherein:  
the light conducting element forms a base plate of the housing and includes  
a broad area of connection with the windshield.

24. (New) The rain sensor according to claim 23, further comprising:  
a common printed board on which is mounted the plurality of optical and  
electronic components in accordance with SMD technology.

25. (New) The rain sensor according to claim 24, further comprising:  
an integrated connector for an electrical connection to a downstream analysis unit,  
wherein:

the housing corresponds to a rectangular-shaped sensor housing.

26. (New) The rain sensor according to claim 25, further comprising:  
contact pins through which the printed circuit board is connected to the integrated  
connector.

27. (New) The rain sensor according to claim 20, wherein:  
the rain sensor is cemented to an inside of the windshield.

28. (New) The rain sensor according to claim 27, further comprising:  
a transparent film that is self-adhesive on each side thereof and corresponds to a connection between the windshield and the light conducting element.
29. (New) The rain sensor according to claim 20, wherein:  
the output signal is provided to a downstream analysis circuit and includes information with respect to an instantaneous degree of wetting of the windshield.
30. (New) The rain sensor according to claim 29, wherein:  
at least one of a windshield wiper mechanism and a vehicle lighting system is activated as a function of the output signal.
31. (New) The rain sensor according to claim 20, wherein:  
the at least one transmitter includes at least one LED.
32. (New) The rain sensor according to claim 31, wherein:  
a first one of the at least one receiver that detects an optical signal emitted by the at least one LED includes a photodiode.
33. (New) The rain sensor according to claim 20, wherein:  
the at least one receiver includes at least one ambient light sensor.
34. (New) The rain sensor according to claim 33, wherein:  
the at least one ambient light sensor includes an aperture angle of approximately 40° inclined upward with an aperture direction in a direction of travel.
35. (New) The rain sensor according to claim 34, wherein:  
the at least one ambient light sensor is sensitive to an ultraviolet light.
36. (New) The rain sensor according to claim 35, wherein:  
the ultraviolet light corresponds to sunlight.

37. (New) The rain sensor according to claim 20, wherein:  
if an infrared light is used, the light conducting element is formed of a black plastic.
38. (New) The rain sensor according to claim 20, wherein:  
the light conducting element includes optical areas formed from transparent plastic for the at least one receiver.
39. (New) The rain sensor according to claim 20, wherein:  
the light conducting element includes a plastic part formed according to a two-color injection molding process.
40. (New) The rain sensor according claim 20, wherein:  
the light conducting element is formed by combining two single-color plastics.
41. (New) The rain sensor according to claim 20, wherein:  
the light conducting element includes integrated lens structures for light bundling.

**IN THE ABSTRACT:**

On page 10, delete the Abstract and insert in its place:

**--Abstract Of The Disclosure**

A rain sensor, for motor vehicles in particular, having one measuring distance with at least one transmitter and at least one receiver for electromagnetic waves (light waves), a windshield being arranged in the measuring distance, and the measuring distance influencing the wave propagation between the at least one transmitter and the at least one receiver in such a way that when a coating forms on the windshield, in particular as the result of wetting by precipitation, an output signal sensed by the receiver is changed. It is provided that the optical and electronic components of the rain sensor are mounted in a housing, a light conducting element forming a cover of the housing.--.

### Remarks

This Preliminary Amendment cancels, without prejudice, claims 1-19 in the underlying PCT Application No. PCT/DE99/00020. This Preliminary Amendment also adds new claims 20-41. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

The above amendments to the drawings, specification and abstract conform the drawings, specification and abstract to U.S. Patent and Trademark Office rules, and do not introduce new matter into the application.

The underlying International PCT Application No. PCT/DE99/00020 includes an International Search Report, dated July 13, 1999, and an International Preliminary Examination Report dated June 6, 2000, copies of which are submitted herewith.

Applicants assert that the present invention is new, non-obvious, and useful. Consideration and allowance of the claims are requested.

Respectfully submitted,

By: *Richard L. Mayer* (Reg. No. 41,172)

Dated: 10/10/00

By: *Richard L. Mayer*  
Richard L. Mayer  
Reg. No. 22,490

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RAIN SENSOR

The invention relates to a rain sensor having the features cited in the precharacterizing portion of Claim 1.

## Background Information

Windshield wiper mechanisms for windshields of motor vehicles are known, the windshield wiper being controlled not only via a conventional steering column lever but also additionally via an optical rain sensor. The optical rain sensor normally includes a light source, the electromagnetic radiation of which is reflected in different ways by the windshield as a function of the moisture coating on the windshield. The reflected component is detected using a photoelectric cell so that an output signal of the rain sensor corresponding to the moisture coating can be supplied. These output signals can be analyzed and used to control the windshield wipers in such a way that both the switching on as well as the wiper speed are varied as a function of a measured quantity of rain.

Known rain sensors are customarily mounted on the inside of the windshield, preferably behind an interior rear-view mirror. Cemented metal feet, for example, are used for mounting. Also known are mountings using an additional frame which is previously joined to the windshield and the rain sensor housing is pressed into it later.

## Advantages of the Invention

The rain sensor according to the present invention having the features cited in Claim 1 has in particular the advantage that essentially only three single parts are required for its construction. The rain sensor is essentially made up of a housing from which the electrical conductors for the connection to a downstream analysis unit are guided, a printed circuit board as well as a light conducting element which preferably already has all the necessary optical lens structures. As a result, a cost-effective, very compact and easily mountable rain

sensor is provided. The rain sensor can be easily mounted in particular via a transparent film which is preferably self-adhesive on both sides without having an adverse effect on its optical characteristics. Moreover, the rain sensor can be manufactured with few assembly steps so that it can be produced cost-effectively in mass production.

The mounting of all required electronic and optoelectronic components on a common printed circuit board, preferably mounted using SMD (surface mounted device) technology, makes it possible to implement very compact sensors which in addition can be mounted in the vehicle without difficulty. Consequently, a rain sensor of this type can be designed to be significantly more compact than known rain sensors and like them, it can be mounted, for example, behind an interior rear-view mirror on the inside of the windshield.

In a preferred embodiment of the present invention, the light conducting element simultaneously forms the cover of the sensor housing and in this way forms a complete electronic housing with it. The connection can be secured in an advantageous manner by clipping in place. A detachable protective film on an exterior adhesive side of the transparent adhesive film simultaneously protects the light conducting element against mechanical damage during transport. The very compact structure makes it possible for automotive manufacturers as customers of such rain sensors to perform simple and fast and consequently very cost-effective installation, which in addition can be automated without difficulty.

An output signal of the rain sensor according to the present invention can be advantageously used to control a windshield wiper mechanism and/or a vehicle lighting system. Thus, for example, it can be practical to switch on additional front fog lamps automatically with heavy rain or fog.

In a preferred embodiment of the invention, a brightness sensor for ambient light may also be integrated in addition to the rain sensor, the brightness sensor delivering a signal to a large extent influenced by daylight and accordingly having a relatively wide conical aperture that is directed upward for incident light. It is a further advantage if the brightness sensor is sensitive to ultraviolet light components such as are present in sunlight but not in artificial light. In this manner, it is possible to avoid a false tripping by intense artificial light, for example, during travel through a tunnel.

The incident light can be focused in an advantageous manner by the light conducting element which acts simultaneously as a base plate for the sensor housing. Such a light conducting element may, for example, be produced from a plastic such as PMMA (polymethyl methacrylate) by injection molding, it being possible to incorporate optical structures such as convergent lenses in the molding process in a simple manner. If infrared light is used for the rain sensor function, it is advantageous to produce the light conducting element from black PMMA and to provide merely the light passage for the ambient light sensor from clear plastic. This can be implemented, for example, by processing using a two-color injection method or by combining, for example, by gluing or fusing, two single-color plastic parts.

Additional advantageous embodiments of the present invention result from the other features named in the subordinate claims.

## Drawings

The invention will be explained in greater detail below with exemplary embodiments with reference to the associated drawings in which:

Figure 1a shows a diagrammatic side view of a rain sensor according to the present invention,

Figure 1b shows a diagrammatic plan view of the rain sensor of Figure 1,

Figure 2 shows a diagrammatic section of the rain sensor according to the present invention in an exploded view and

Figure 3 shows a light conducting element in a perspective view.

## Description of the Exemplary Embodiments

Figure 1a shows a rain sensor 4 according to the present invention in a diagrammatic side view, it being possible to fasten the rain sensor to the inside of a windshield 2 of a motor vehicle. Rain sensor 4 can be mounted behind windshield 2 by cementing, for example, at the

level of an interior rear view mirror which is not shown here. Positioning behind the rear view mirror results in no additional obstruction of vision for a driver. The electronic and optoelectronic components of rain sensor 4 are enclosed by a housing 6 which is non-transparent in the direction of the interior, i.e., the passenger compartment. The bottom of the housing, which forms a broad area of connection with windshield 2, represents a light conducting element 10 into which all the optical structures (lens structures, light conducting structures and the like) needed for function have been incorporated. This can be accomplished, for example, by the injection molding of a suitable optically transparent plastic. For the mechanical and optical coupling of rain sensor 4 with the windshield, light conducting element 10 is joined to windshield 2 by a transparent adhesive film 36 which is self-adhesive on both sides.

Figure 1b shows a diagrammatic plan view of rain sensor 4 according to Figure 1a. It shows a connector 38 for the electrical connection to a downstream analysis unit which, however, is not shown here. It can variably activate a windshield wiper mechanism and/or a vehicle lighting system using signals delivered by rain sensor 4. Depending on the embodiment, connector 38 can have four or, for example, eight connector pins which penetrate into a mounted printed circuit board in housing 6 and are soldered or pressed there to produce an electrical connection.

Figure 2 shows a diagrammatic section of rain sensor 4 according to the present invention in an exploded representation. A printed circuit board 8 can be inserted into pot-shaped housing 6, which is open at the bottom in this representation, against an offset 14 within housing 6, electronic and optoelectronic components being mounted on the circuit board using, for example, SMD (surface mounted device) technology. In order to positively secure printed circuit board 8 in housing 6, it is in contact with offset 14 in the housing after having been pressed over circumferential groove 12 during insertion. This holds printed circuit board 8 tightly in place and prevents it from falling out downwards. In addition, connector pins 16 which protrude into the interior of housing 6 can be seen, the connector pins being connected, for example, to the matching conductors of printed circuit board 8 by partial soldering or the like. A conductive compression joint is also possible.

A light emitting diode or LED 15 mounted on the top of printed circuit board 8 is required,

for example, as the component which emits visible or infrared light in the form of a directional light beam. The light beam strikes windshield 2 at an acute angle and is normally completely reflected due to its refractive index at the windshield's outer boundary surface to the air and strikes a photodiode as a reflected component in nearly complete form, the photodiode also being mounted at a suitable position on the top of circuit board 8. If a droplet of water is now located at the site of the reflection of the light beam on the outside of windshield 2, the result is a changed refractive behavior at the outer boundary surface of the windshield to the air, as a result of which the light beam is not completely reflected at the boundary surface but rather a scattered component which escapes to the outside occurs. The signal of the reflected component which is attenuated in this way can be detected by the photodiode and analyzed quantitatively and thus registered as a haze of moisture or rain on the outside of windshield 2 of the motor vehicle.

The desired focusing of the light beam, i.e. the reflected component, can advantageously be achieved by a suitably shaped light conducting element 10 made up of a highly transparent and readily injection moldable plastic such as PMMA (polymethyl methacrylate) which simultaneously forms the base side of housing 6 and is joined to windshield 2 with a broad area of contact via a transparent adhesive film 36. With suitable molding, preferably using injection molding, light conducting element 10 can contain molded lens-shaped structures which provide the desired focusing and bundling of the light emitted by LED 15 as well as the light components detected by the photodiode.

In addition, an ambient light sensor 22 is arranged on printed circuit board 8, the light sensor detecting the brightness of the ambient light passing through windshield 2 of the motor vehicle and being able to generate a control signal dependent on the ambient light for an automatic light control or for a day/night changeover of the windshield wiper control in the motor vehicle. Advantageously, ambient light sensor 22 reacts preferably to specific UV light components which are present only in natural sunlight in order to thus prevent the vehicle headlights from being unintentionally switched off in brightly illuminated tunnels or underpasses with strong artificial light sources.

If infrared light is used for rain sensor 4, light conducting element 10 may be made of, for example, black PMMA and include only a small place for ambient light sensor 22 of clear

material.

Also shown is transparent adhesive film 36 which produces a broad area of connection to windshield 2, an additional detachable protective film 3 on transparent adhesive film 36 being shown in Figure 2. After this protective film 3 is removed, rain sensor 4 can be easily cemented to the desired position on windshield 2. Protective film 3 serves to protect light conducting element 10 and adhesive film 36 from mechanical damage during transport, installation or the like.

For clarification, Figure 4 once more shows a perspective view of light conducting element 10 with the focusing structures (convergent lenses) incorporated in it by injection molding. Visible at each outside edge is a longitudinal groove 19, into which a matching stud 18 of housing 6 can be clipped (Figure 2), thus making a tightly joined connection possible between lower open housing 6 and light conducting element 10 forming the lower housing cover.

## Patent Claims

1. A rain sensor, for motor vehicles in particular, comprising one measuring distance having at least one transmitter and at least one receiver for electromagnetic waves (light waves), a windshield being arranged in the measuring distance, and the measuring distance influencing the wave propagation between the at least one transmitter and the at least one receiver in such a way that when a coating forms on the windshield, in particular as the result of wetting by precipitation, an output signal sensed by the receiver is changed, characterized in that the optical and electronic components of the rain sensor (4) are mounted in a housing (6), a light conducting element (10) forming a cover of the housing (6).

2. The rain sensor according to Claim 1, characterized in that the light conducting element (10) forms a base plate of the sensor housing (6) which has a broad area of connection with the windshield (2).

3. The rain sensor according to Claim 2, characterized in that all optical and electronic components of the rain sensor (4) are mounted on a common printed circuit board (8) using SMD technology.

4. The rain sensor according to Claim 3, characterized in that the rain sensor (4) is mounted in a rectangular-shaped sensor housing (6) having an integrated connector (38) for the electrical connection to a downstream analysis unit.

5. The rain sensor according to Claim 4, characterized in that the printed circuit board (8) is connected to the connector (38) on the sensor housing (6) via contact pins.

6. The rain Rain sensor according to Claim 7, characterized in that the rain sensor (4) is cemented to the inside of the windshield (2).

7. The rain sensor according to Claim 6, characterized in that a transparent film (36) which is self-adhesive on both sides is provided

as a connection between the windshield (2) and the light conducting element (10) of the rain sensor (4).

8. The rain Rain sensor according to one of the preceding claims, characterized in that an output signal of the rain sensor (4) to a downstream analysis circuit contains information concerning an instantaneous degree of wetting of the windshield (2).

9. The rain sensor according to Claim 8, characterized in that a windshield wiper mechanism and/or a vehicle lighting system can be activated as a function of the output signals of the rain sensor (4).

10. The rain sensor according to one of the preceding claims, characterized in that the at least one transmitter is an LED (15).

11. The rain sensor according to Claim 10, characterized in that the first receiver which detects the optical signal emitted by the at least one LED (15) is a photodiode.

12. The rain sensor according to one of the preceding claims, characterized in that at least one ambient light sensor (22) is provided as a second receiver.

13. The rain sensor according to Claim 12, characterized in that the ambient light sensor (22) has an aperture angle of approximately  $40^\circ$  inclined upward with an aperture direction in the direction of travel.

14. The rain sensor according to one of Claims 12 or 13, characterized in that the at least one ambient light sensor (22) is sensitive to ultraviolet light, sunlight in particular.

15. The rain sensor according to one of the preceding claims, characterized in that if IR (infrared) light is used, the light conducting element (10) for the rain sensor function is made of black plastic.

16. The rain sensor according to one of the preceding claims, characterized in that optical



areas in the light conducting element (10) are provided from transparent (clear) plastic for the at least one receiver (20).

17. The rain sensor according to one of the preceding claims, characterized in that the light conducting element (10) includes a plastic part made using two-color injection molding.

18. The rain sensor according to one of the preceding claims, characterized in that the light conducting element (10) can be produced by combining two single-color plastics.

19. The rain sensor according to one of the preceding claims, characterized in that the light conducting element (10) is provided with integrated lens structures for light bundling.

## Abstract

The invention relates to a rain sensor, for motor vehicles in particular, having one measuring distance with at least one transmitter and at least one receiver for electromagnetic waves (light waves), a windshield being arranged in the measuring distance, and the measuring distance influencing the wave propagation between the at least one transmitter and the at least one receiver in such a way that when a coating forms on the windshield, in particular as the result of wetting by precipitation, an output signal sensed by the receiver is changed.

It is provided that the optical and electronic components of the rain sensor (4) are mounted in a housing (6), a light conducting element (1) forming a cover of the housing (6).

(Figure 1a)

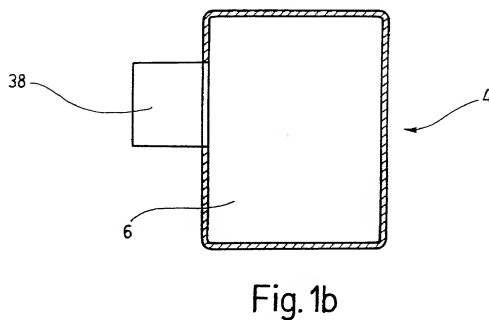
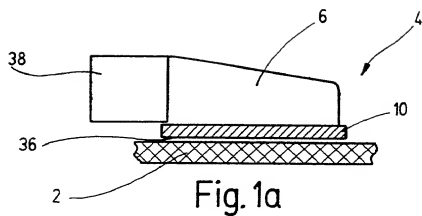


Fig. 2

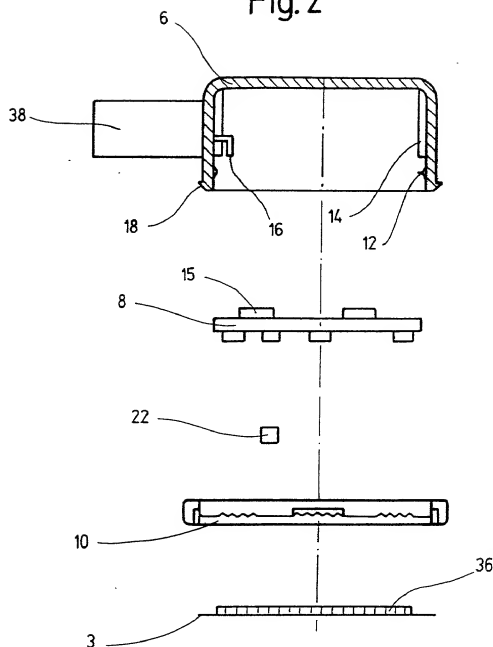
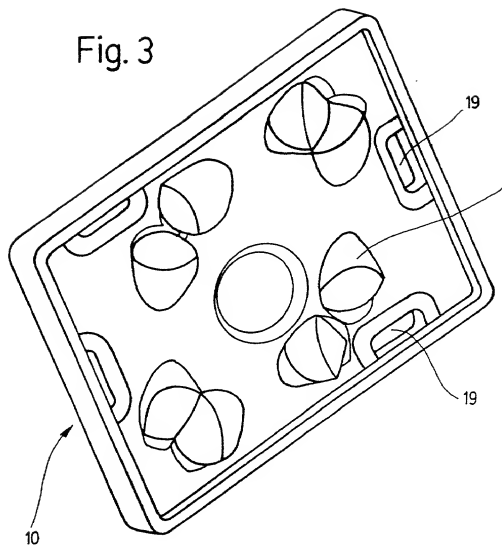


Fig. 3



COMBINED DECLARATION AND  
POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **RAIN SENSOR**, and the specification of which:

- ☐ is attached hereto;
- ☐ was filed as United States Application Serial No. \_\_\_\_\_ on \_\_\_\_\_, 19\_\_ and was amended by the Preliminary Amendment filed on \_\_\_\_\_, 19\_\_.
- ☒ was filed as PCT International Application Number PCT/DE99/00020, on the 8th day of January, 1999.
- ☒ an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

2L 307702 720

2L 307701 211

**PRIOR FOREIGN/PCT APPLICATION(S)**  
**AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119**

Country : Germany

Application No. : 198 15 749.5

Date of Filing: April 8, 1998

Priority Claimed

Under 35 U.S.C. § 119 : ☒ Yes    ☐ No

Country : Germany

Application No. : 198 42 077.3

Date of Filing: September 15, 1998

Priority Claimed

Under 35 U.S.C. § 119 : ☒ Yes    ☐ No

Country : Germany

Application No. : 198 46 968.3

Date of Filing: October 12, 1998

Priority Claimed

Under 35 U.S.C. § 119 : ☒ Yes    ☐ No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR  
PCT INTERNATIONAL APPLICATIONS  
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120**

U.S. APPLICATIONS

Number :

Filing Date :

PCT APPLICATIONS  
DESIGNATING THE U.S.

PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.



1-00

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